Improve the transmission quality and the energy efficiency of satellite communication systems with SCHC

SCHC, the new IETF standard for header compression, has demonstrated its relevance for satellite communication systems. By measuring gains of around 20% on the transfer time of a web page compared to RoHC, a recent study from the R&T program of the French space agency (Centre National d'Etudes Spatiales, CNES) and led by Acklio (leader of the SCHC technology) and Viveris Technologies (specialized in embedded systems and satellite telecommunications), positions SCHC as a serious candidate to optimize satellite communications.

Header compression techniques provide a way to reduce the size of the headers used to signal messages in communication networks. This means more space to transmit useful data, and therefore more use cases offered on the same network. Also, by reducing the volume of data transmitted, these technologies have a direct impact on the quality of communication (latency, packet loss), the autonomy of connected objects and the network load.

The standard for header compression deployed in satellite systems today is **RoHC** (Robust Header Compression, RFC 3095), published in 2001. RoHC is a dynamic compression mechanism, optimized according to the data flow and the quality of the radio link. It therefore requires preliminary packet exchanges before it is effective. **SCHC** (Static Context Header Compression, RFC 8724), published in 2020, is a static compression standard, which means that it does not require prior learning phase. Initially designed for the Internet of Things (IoT), SCHC's scope of application extends to a wider spectrum of connectivity related to the Internet world.

Thanks to CNES R&T program, Acklio and Viveris Technologies have investigated the respective performances of RoHC and SCHC, both in a Very High Throughput Satellite (VHTS) geostationary orbit (GEO) context, and in an IoT context using a Low Earth Orbit (LEO) satellite constellation context. The main findings are as follows:

1. The absence of a learning phase for **SCHC allows for optimal compression from the very first few bytes** exchanged. RoHC, on the other hand, requires the exchange of 7 to 8 packets before being efficient. Thus, where RoHC is efficient for long flows with established regime (such as video and VoIP), the study shows the relevance of SCHC for short communications, such as IoT or brief TCP sessions. The study for example highlights gains of some 20% compared to RoHC on Web browsing. A figure that should be further improved for traffic based on QUIC (Quick UDP Internet Connections, RFC 9000), the new HTTP/3 standard based on UDP and which represents 30% of current Web traffic.

2. **SCHC natively supports IPv6 and IPv4 even in the most constrained environments.** RoHC does not work on IPv6 for small packet sizes, because initialization packets need at least 40 bytes. And on IPv4, it requires fragmentation on the first packets.

3. **SCHC compression shows robustness and resilience to network losses.** RoHC is not very reliable when the flow degrades, especially in the event of congestion or burst losses. Indeed, in case of packet loss - and therefore context loss, RoHC has to complete a new learning cycle before the compression is effective again. In broadband configuration, SCHC offers a quality of service close to the original TCP quality of service. And in some cases, SCHC can deliver a higher throughput and therefore a better experience on VoIP use cases thanks to compression.

Following these significant results obtained through CNES R&T program, Acklio will pursue the integration of SCHC in a software suite dedicated to the satellite market. The startup is exploring partners in the LEO and GEO domains to apply these optimizations to new use cases. Furthermore, CNES and Acklio invite you to contact them for a detailed presentation of the study and implementation of the SCHC technology: contact@ackl.io, nicolas.kuhn@cnes.fr.

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About Acklio: Expert in communication protocols, the startup Acklio innovates on the Internet of Things market with a software suite bringing significant benefits for interoperability, security and energy efficiency of IoT deployments. Acklio's co-founders pioneered a technology that brings the ability to transport IP-based applications to the new constrained networks of the IoT. This mechanism, called SCHC for "Static Context Header Compression", was published as an IETF standard in 2020. As international leader in SCHC, Acklio's software accelerates the time to market and ensures the long-term sustainability of IoT solutions.

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Press kit and illustrations: http://bit.ly/acklio-presskit

About Viveris Technologies: For more than 30 years, the Viveris Group has been studying, developing, integrating and deploying information and embedded systems for large accounts and mid-sized companies in the industry, the telecommunications and the tertiary sector. A long-standing player in engineering, consulting, digital technologies and services, the Viveris Group (62 M€ turnover in 2020) employs 780 people in France (Boulogne, Rungis, Belfort, Grenoble, Lille, Lyon, Strasbourg, Toulouse, Montpellier and Marseille).

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